

LAKE REGION.

Seasonal distribution of fog.—February is the month of greatest fog frequency on the lakes, and July and August the months of least frequency, with more marked seasonal characteristics and greater frequency over the southern portion of the district.

Conditions favorable for fog formation.—(1) Low pressure on the leeward side of the lakes and relatively high pressure on the windward side, with a weak gradient (0.10 inch in 100 to 250 miles). (2) Temperature differences more or less marked between the water and land surfaces. In about two-thirds of the cases the water temperature was the lower. (3) Relative humidity above normal, averaging above 90 per cent. (4) The occurrence of precipitation from 24 to 36 hours previous to the fog, usually to the westward and southward of the lakes. (5) Low wind velocities, less than 15 miles an hour (less than 6 miles above one-third of the time).

Region of maximum frequency.—From the southern third of Lake Michigan eastward over extreme southern Lake Huron to western Lake Erie.

Form of fog covering.—Usually uniform like a blanket, but quite frequently in banks, or bands, both along shore and over the water. The blanket form is most prevalent when the low-pressure systems are moving slowly toward the lakes.

ATLANTIC COAST.

Regions of maximum frequency (with diagram).—The region of greatest frequency is the eastern coast of Maine with a steady decrease to almost zero at Key West, Fla., with a few explainable exceptions.

- (1) Fogs are most frequent where the water temperatures are lowest.
- (2) Fog frequency in any given locality is proportional to the differences in temperature between the land and water surfaces.

Geographic distribution of fog.—This is almost entirely a question of pressure distribution and resulting wind direction. Fog occurs at times along the entire coast from Eastport, Me., to Jacksonville, Fla., and from thence westward along the Gulf coast to the mouth of the Rio Grande; at other times from the Maine coast to Hatteras, N. C., to Cape May, N. J., to New York, etc. Another fog type extends along the ocean from northeast to southwest, touching the coast at only a few points, such as Nantucket, Mass., and Hatteras, N. C.

Seasonal distribution (with table).—Fog is most frequent in midsummer on the New England coast, and least frequent in winter; most frequent in winter and early spring on the Middle and South Atlantic coasts, and least frequent in midsummer.

GULF OF MEXICO.

The same general rules apply to Gulf of Mexico fogs as to those of the Lakes and the Atlantic coast. The region of maximum frequency occurs between the northwest coast of Florida and the northeast coast of Texas, the number of foggy days increasing from east to west. (Diagram and table.)

The season of greatest frequency is winter, and that of least frequency summer, fog being very rare in the latter season owing to the high temperatures and the high vapor content of the air.

GENERAL NOTES.

- (1) Fog belts appear to "travel," generally from west to east, but occasionally in the opposite direction.
- (2) A good fog type for the South Atlantic and Gulf coasts is high pressure over Bermuda and low pressure over Texas and Oklahoma, with a very weak gradient.
- (3) Fogs form frequently on the Atlantic coast with low pressure north of Lake Superior, moving northeastward.
- (4) The fog belt is not always continuous along a coast.

SLEET AND ICE STORMS IN THE UNITED STATES.

By H. C. FRANKENFIELD.

[Author's abstract.]

Definition of terms.—Sleet is precipitation that occurs in the form of frozen, or partly frozen, rain, and is formed by rain falling from a relatively warm air stratum into and through another air stratum that is sufficiently cold to freeze some or all of the rain drops. Mixtures of snow and rain are not sleet; neither are mixtures of hail and rain. A modification of sleet, but not true sleet, is rain that actually falls to the surface as rain, but freezes as soon as it touches the surface. This is the form that causes the greatest damage.

The etymology of the term is uncertain. Some of the earlier equivalents are the Middle High German "Sloze," the German "Schlosse," and the Norwegian "sletta," the latter meaning to "slap." Sleet and hail are different, both formatively and structurally.

Geographical distribution.—Sleet storms are very rare west of the Rocky Mountains and along the eastern slope of the mountains. The region of greatest frequency is over the great interior valleys, and from

thence eastward, that is, over the section traversed by the principal low pressure systems. (See diagram.)

Seasonal distribution.—The months of greatest sleet frequency are January and February over the Great Valleys, the Lower Lakes, and the Middle Atlantic States, and March and December over the Upper Lakes. The Upper Lake storms are rarely so severe as the others. Sleet has been observed as late as May and as early as October 3.

Conditions favorable for sleet and ice storms.—(1) Low pressure and high temperature to the northward; 72 per cent well developed and 28 per cent fairly so; no failures.

(2) Steep pressure and temperature gradients to the northward; 69 per cent well developed and 12 per cent fairly so; 19 per cent failed.

(3) Surface temperatures below the freezing point, usually between 22°F. and 28°F.

(4) Moderately high pressure and high temperature over the East Gulf and South Atlantic States. This occurred in 70 per cent and failed in 30 per cent of the cases.

(5) Northward looping of the isotherms (surface inversion). True in 88 per cent of the cases.

(6) Gentle to fresh northerly winds, increasing by the time sleet begins. Almost uniformly true.

(7) Low pressure trough between two highs, trending from southwest toward northeast. Low center, usually moving from southwest.

Sleet or snow, which?—(1) The steep temperature gradients to the northward of the storm center that precedes sleet are not necessarily in advance of heavy snow.

(2) The high temperatures over the Gulf and South Atlantic States necessary to sleet formation are absent before and during heavy snows.

(3) The warm southerly winds over the Gulf and South Atlantic States come from warm water surfaces, and carry a much larger water-content than winds from any other directions. Out of 34 cases of sleet, 29 were preceded by warm southerly winds over the South Atlantic and East Gulf States, while out of 48 cases of heavy snows, 28 were preceded by cool weather over the South and only 5 by warm weather.

CLIMATIC FLUCTUATIONS DURING THE HISTORIC EPOCH.

By ANTONIO GALÁN, S. J.

[Author's abstract.]

The investigations which Dr. Ellsworth Huntington, professor at Yale University, has made in the ruins which are found in an extensive area in southern Arizona, New Mexico, Yucatan, and Guatemala have cleared up in a great measure the difficult problem of the climatological fluctuations in historic times.

From these investigations the deduction is made that numerous tribes inhabited these regions, engaging principally in agriculture, while at the present time the cultivation of the soil is impossible.

A study of the terraces of America and their comparison with the investigations of Penck in Asia leads to the same conclusion.

Finally, the method of investigation introduced by Dr. Andrew E. Douglass, professor of the University of Arizona, in the study of the development of the pines of Arizona and New Mexico, and applied by Dr. Huntington to the sequoias of California, is still another argument in favor of this hypothesis. The curves which represent the annual development of these trees in periods of from 300 to 500 years present notable variations. These variations appear to be due to climatic fluctuations, since the annual development of trees is determined by their alimentation, and this depends in great part upon the amount of rainfall.

If this is true, the investigations made of the development of trees will indicate not only that there existed notable climatic variations in historic times but also that these variations were in the nature of pulsations.

All this leads to the belief that the cause of these fluctuations must be sought in the displacement of the great climatic zones of the earth. In historic times climatic variations were probably of the same character as those of the glacial period. Regions which are passing through a similar period are those of permanent high pressure. According to this a part of the United States might be under the influence of an area of high pressure during the whole year. The storms which to-day cross from the Pacific to the Atlantic, providing the greater part of the precipitation in the regions which they cross, would be obliged to move southward, thus supplying an abundant rainfall for the arid regions of the Southwest.

Investigations which have been made of the ruins found in the forests of Yucatan and adjacent regions indicate that the climate there was drier, more varied, and less enervating than at present. This confirms the above ideas; for if the storms of the West were pushed toward the South it might result that regions like Yucatan would have the varied climate which characterizes the central part of the United States. The trade winds would be destroyed or pushed toward the south, causing abundant and continuous rains, thus prolonging the dry season and making the climate fresher and more varied.